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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re United States Patent Application of:

Applicant: STAUF, Gregory T., et al.

Application No.: 09/681,609

Date Filed: May 8, 2001

Title: BARRIER STRUCTURES FOR
INTEGRATION OF HIGH K
OXIDES WITH Cu AND Al
ELECTRODES

Docket No.: 2771-497 (7486)

Examiner: Thao X. LE

Art Group: 2814

Confirm. No.: 8601

Customer Number

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DOCUMENTATION OF SEPTEMBER 17, 2003 TELECONFERENCE WITH
EXAMINER DISCUSSING IMPROPER REFUSAL TO ENTER AUGUST 19, 2003
RESPONSE IN U.S. PATENT APPLICATION NO. 09/681,609

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Sir:

This documents the teleconference with the undersigned attorney with Examiner Thao X. Le on September 17, 2003, concerning the erroneous refusal of the Office to enter the Response filed August 19, 2003.

Upon review of the Advisory Action issued on September 11, 2003, in which Form PTOL-303 was incompletely set forth (specifically, it was not indicated by appropriate check box whether the Response was entered, or alternatively was refused entry), the undersigned attorney contacted Mr. Le on September 17, 2003.

Examiner Le informed the undersigned attorney that the Response filed August 19, 2003 had not been entered in the case, because claim 27, indicated prospectively allowable in the May 19, 2003 Office Action if rewritten in independent form, had not been re-written in proper form *with all limitations of the base and intervening claims contained therein.*

Specifically, the Examiner indicated that in the rewritten claim 27, aluminum had not been set forth as a metal species of the "at least one metal layer" recited in claim 1.

The undersigned attorney after review of the claims pointed out to the Examiner that claim 1 contained the restriction that **"when said material of said at least one metal layer is Al, said at least one material of said conductive barrier layer is not Ir or IrO₂."**

Since claim 27 recited the barrier layer as containing Ir and IrO₂, the proper effect of the language in claim 1 quoted in the preceding paragraph necessitated that the metal in the "at least one metal layer" in the rewritten claim 27 be limited to Cu.

Examiner Le acknowledged this, and confirmed that the undersigned attorney should file a further paper in the application discussing this circumstance, whereupon the Examiner would discuss the issue with his supervisor.

It therefore is requested that Examiner Le consider the foregoing and discuss same with his supervisor to correct the wrongful refusal of entry of the August 19, 2003 Response, since the Response should in fact have been entered, and claim 27 as rewritten should have been formally allowed.

Further, for completeness of the record, the Examiner's remarks in the September 11, 2003 Advisory Action are addressed below.

The Examiner in the Advisory Action stated that the August 19, 2003 Response did not place the application in condition for allowance on the following stated grounds:

- (1) The Applicant argues that Tsu's "metal silicide layer 20" is different from the "metal alloy" of the claimed invention. This is not persuasive because it has been held that the use of the term "comprise" leaves a claim open for inclusion of materials or step other than those recited in the claim (citing Ex parte Davis, 80 USPQ 448 (PTO Bd. App.)); and
- (2) The Applicant argues that "there is no reason why one would change the specific barrier composition of TiN of Lu with Tang's TiAlN. This is not persuasive because Tang clearly discloses TiN or TiAlN can be used alternatively as diffusion barrier, column 9 line 26-28. Also, substitution of equivalent requires no express motivation as long as the prior art recognizes the equivalency (citing In re Fount 213 USPQ 532 (CCPA 1982) and In re Siebentritt 152 USPQ 618 (CCPA 1967)).

These points are addressed below.

Point (1)

The claim language at issue is set out below:

"at least one metal layer in contact with the conductive barrier layer, wherein said metal layer comprises metal or metal alloy including material selected from the group consisting of Cu and Al"
(claim 1)

The Examiner has taken the position that applicants' recitation of "metal alloy" as a composition of applicants' recited "metal layer," includes Tsu's "metal silicide."

The Examiner's interpretation is at odds with the clear contextual meaning of the term "metal layer," as referring to a pure metal or mixed metal composition.

The application clearly describes metal electrodes in integrated circuit memory cells or other electronic devices - indeed, the title of the application, "Barrier Structures for Integration of High K Oxides With Cu and Al Electrodes," makes clear that the metalization referred to in the claims as constituting "at least one metal layer" is the electrode component of the recited microelectronic structure.

In this respect, see also the specification at page 4, line 12 ("aluminum and copper have come into usage as alternative electrode materials") and at page 5, lines 14-16 ("the present invention therefore relates to use of various barrier layers between the complex metal oxides of high dielectric constant and the Cu or Al electrodes, to avoid the above-discussed problems").

The Examiner's interpretation of "metal alloy" as being open to the inclusion of all materials other than those recited in the claim - e.g., wood, air, water, gas, etc - is a logical absurdity that is inconsistent with (i) the plain and simple recital of "at least one metal layer" and (ii) the clear and unambiguous meaning of such term as understood by those skilled in the art from a reading of applicants' disclosure and claims.

A metal layer, simply stated, is a metal layer - it is not a metal silicide.

It is elemental patent law that the claims are construed and interpreted in light of the specification. See *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed.Cir.1995) (en banc), aff'd, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996) ("Claims must be read in light of the patent specification.")

Further, it is old and well-established law that a claim to a composition comprising ingredients cited in the claim does not necessarily leave the claim open for inclusion of predominant amounts of unspecified ingredients or in such proportions to have an adverse effect on the basic composition. See *Ex parte Fitzpatrick* (Pat.Off.Bd.App. 1947), 82 USPQ 59 and *Ex parte Geemzki* (Pat.Off.Bd.App. 1948), 82 USPQ 120. In this respect, it is to be noted that the replacement of a substantial amount of metal with silicon in the electrode as proposed by the Examiner (for this is the net result of using Tsu's silicide composition as "the metal layer") would have a severe adverse effect on the resulting layer, precluding its proper performance as an electrode.

For all these reasons, the Examiner is requested to reconsider point (1), in connection with the entry of the August 19, 2003 Response.

Point (2)

The Examiner has taken the position that the Tang reference justifies using TiAlN in place of Lu's TiN, as equivalents, and the Examiner has stated that "substitution of equivalent requires no express motivation as long as the prior art recognizes the equivalency."

The prior art, however, has NOT held that TiN = TiAlN as a general purpose diffusion barrier.

To the contrary, Tang has proposed TiAlN as a **SPECIFIC BARRIER MATERIAL** for a **SPECIFIC BARRIER APPLICATION** requiring that the TiAlN constitute a barrier **BETWEEN SPECIFIC ADJOINING MATERIALS**, namely, polysilicon and iridium.

This is apparent from Tang's express teachings, at column 8, lines 11-13:

"A conductive silicon diffusion barrier may be used on top of polysilicon-filled vias as TiN in FIG. 1a to avoid Ir-polysilicon interactions"

(emphasis added; Tang, col. 8, lines 11-13)

Lu has no such polysilicon/iridium structure or diffusional problems.

Since Tang has a **different material composition**, and a **different microelectronic device architecture**, and since Lu very clearly teaches **ONLY the use of TiN, TiSi₃N₄ or TiN_{0.5}B_{0.5}** (see column 4, lines 32-36 of Lu) to form thin film diffusion barriers with "lower resistivity" (column 4, line 46 of Lu), "low contact/via resistance" (column 4, lines 48-49 of Lu), and "higher purity, density, and stability ... films" (column 2, lines 17-18 of Lu), the question that arises is,

"Why would one take Lu's very specific barrier compositions that are expressly stated to provide superior properties and performance advantages, and simply discard them, in favor of a substitution (from Tang) of a different material, taken from a different structure that involves different diffusional issues?"

The Examiner has not answered this question, but instead has taken a position that one barrier material is interchangeable with any other barrier material, for any purpose, regardless of the types of materials and diffusional species involved.

This is inconsistent with the applicable law.

In any obviousness determination based on combination of two or more references, there must be some suggestion or motivation to combine the references, in the teachings of the references, or from the ordinary knowledge of persons skilled in the art, or from the nature of the problem to be solved. The operative question is whether there is something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination. See *WMS Gaming, Inc. v. International Game Technology*, 184 F.3d 1339, 1355 (Fed.Cir. 1999) and *B.F. Goodrich Co. v. Aircraft Braking Systems Corp.*, 72 F.3d 1577, 1582 (Fed.Cir. 1996) ("When obviousness is based on a particular prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference.")

To establish a prima facie case of obviousness based on a combination of the content of various references, there must be some teaching, suggestion or motivation in the prior art to make the specific combination that is present in the applicant's claimed invention. See *In re Dance*, 160 F.3d 1339, 1342 (Fed. Cir. 1998) and *In re Oetiker*, 977 F.2d 1443, 1445 (Fed.Cir.1992).

Tang's teachings are directed to barriers between polysilicon and iridium. There is no such structure in Lu, and no basis in Lu and/or Tang for importing the polysilicon and iridium barrier layer of Tang into the non-analogous structure of Lu.

The teachings of Tang and Lu in the context of their overall disclosures of different materials and different device architectures are relevant to the issue of their combinability, and must be considered. See *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) (a prior art reference must be considered in its entirety, as a whole, including portions that would lead away from the claimed invention).

One cannot select isolated features out of context, and re-implement them in a manner inconsistent with the contextual disclosure of their source references, simply by declaring such

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isolated features interchangeable for all purposes¹. Rather than providing a proper basis for obviousness, such an approach shows only a hindsight attempt to reconstruct the applicants' invention. The law is clear in this respect. Obviousness cannot be established by hindsight combination to produce the claimed invention. *In re Gorman*, 933 F.2d 982, 986, 18 USPQ2d 1885, 1888 (Fed.Cir.1991).

Tang and Lu provide no basis for utilizing TiAlN as a barrier material between a high dielectric constant material layer and a copper or aluminum layer, as in Applicant's claimed invention.

For all the foregoing reasons, the Examiner is requested to reconsider point (2), in connection with the entry of the August 19, 2003 Response.

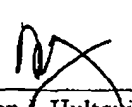
Conclusion

It has been shown above that the August 19, 2003 Response should properly have been entered.

It has additionally been shown that points (1) and (2) set out in the Advisory Action do not in any way present a valid basis for rejection of applicants' claims.

Accordingly, it is requested that the Examiner take cognizance of the foregoing, and responsively allow all pending claims 1-39 upon entry of the August 19, 2003 Response.

Respectfully submitted,



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¹ Just because an apple is a recognized equivalent to an orange *as a fruit* does not mean that oranges can be used to make applesauce.

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